ENR

State Water Survey Division

Illinois Department of
Energy and Natural Resources

SWS Miscellaneous Publication 78

Illinois State Water Survey
Achievements of 1983 - 1984

Champaign, Illinois
July 1984

Illinois State Water Survey
Achievements of 1983-1984

The major achievements of the Water Survey during 1983-1984 relate to economic, environmental and policy issues concerning water and atmospheric matters. Achievements include our ability to provide our three major functions of data collection, research, and services to Illinois and the nation. We note our major achievements in four areas:

- Notable scientific discoveries and advances
- Improvements in research and analytical facilities
- Improved services to Illinois
- Data collection and analysis

NOTABLE SCIENTIFIC ADVANCES

Research addressing a variety of water and climate issues produced notable scientific discoveries and advances in knowledge. A major goal of Water Survey research programs over the past three years has been to develop interdisciplinary research. This included efforts between in-house Sections, with University scientists, and with the other two scientific Surveys. This goal has led to a broadening of our research into many new important areas where the water and atmosphere interface with other disciplines. Highlights of research achievements are given here for the various disciplines.

In Analytical Chemistry

Sampling Procedures. The Water Survey's Analytical Chemistry staff with funding from the USEPA are conducting an analytical methods evaluation and documentation for inorganic ions in rainwater samples. In this project, they will produce an analytical methods manual for use by contracting laboratories and EPA facilities involved with the chemical characterization of wet deposition. Supplemental funding now makes it possible to include sampling and analysis procedures for trace and toxic metals in precipitation.

Weak Acids. The importance of weak acids in addition to the strong nitric and sulfuric acids, commonly thought to be the principal combination of acid precipitation, has been shown. Preliminary data from our laboratory indicate that NH_4 is the dominant 'weak acid' in central Illinois precipitation and a few others are present. The concentrations of these weak acids in some samples were high enough to increase the rain acidity at our Bondville site above the levels expected from sulfuric and nitric acid inputs alone.

In Surface Water

Sediment Studies. This research shows that central and western Illinois produce in-stream sediment loads of up to 1100 tons per square mile per year. Further, 80 to 90 percent of this sediment load in a river moves during a 60- to 90-day storm period, and in dry years, 80 percent may move in a 20-day period. The annual sediment load is a function of annual discharge and drainage area. This is the first time that an attempt has been made to quantify the in-stream sediment yields for Illinois.

Analysis of long-term sedimentation rates at Lake Decatur indicates that the importance of source areas for sediment decreases as the distance from the lake increases. The sedimentation rate within this important lake environment has probably started to decrease.

Pool 19 on the Mississippi River has lost about 55 percent of its capacity since 1913. This pool may attain dynamic equilibrium by the year 2000 when about 67 percent of its original capacity has been lost. Small tributaries are significant local contributors of sediment. The Skunk River, for example, includes only 4 percent of the drainage area of Pool 19, but contributes nearly 25 percent of the sediment load. Extreme events such as the 1973 flood and 1977 drought both impact large rivers – floods by scouring deposits and drought by enhancing vegetation and plant beds. This work is part of the Long-Term Ecological Research (LTER) project in which all three Surveys participate.

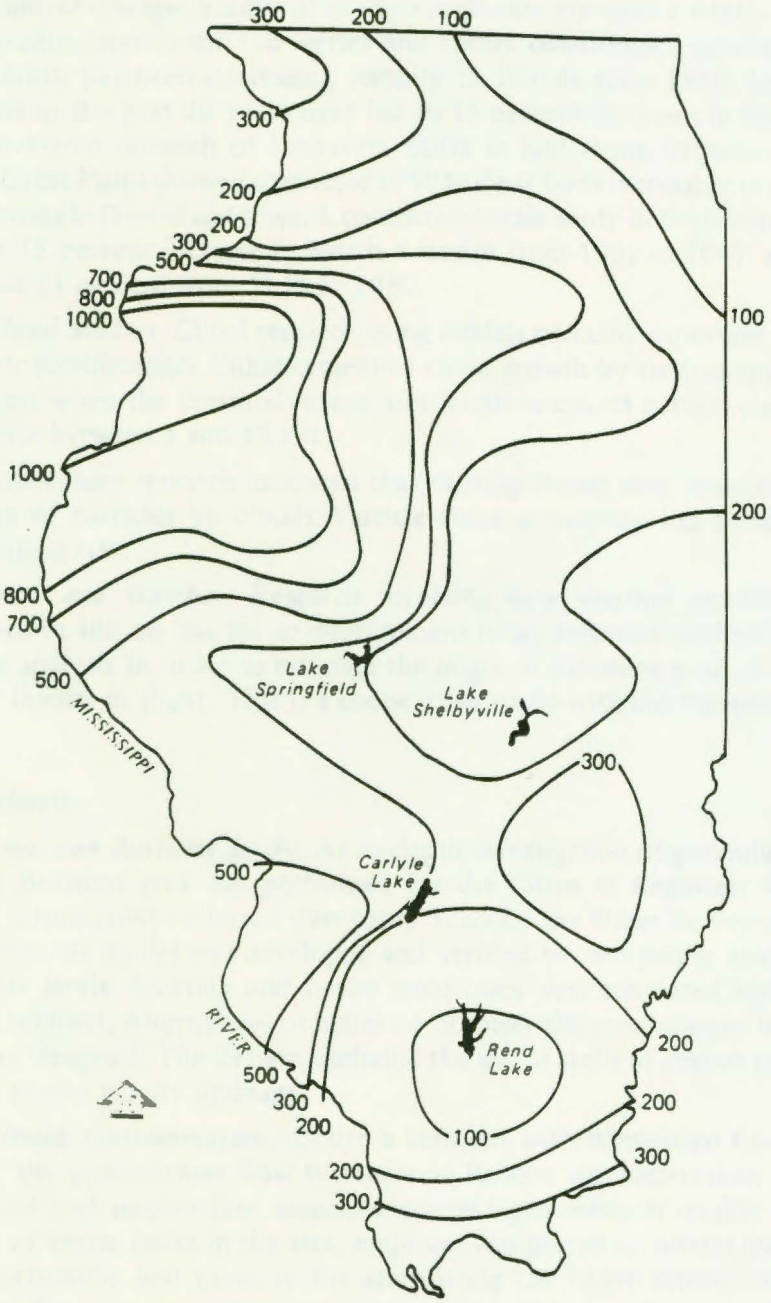
Eleven conceptual models have been developed to describe the erosion and sedimentation process. The models identify the major subdivisions of the environment and the important natural and human factors that influence erosion/sedimentation. Scientists from all three scientific Surveys are involved in this research.

Micro-ILLUDAS. A micro-computer version of the ILLUDAS model has been developed and is available to engineers and researchers in Illinois. The model is designed to run on an IBM-PC but has all the features of the main frame model that has been popular for 10 years.

Urban Runoff. Urban stormwater runoff contains high concentrations of pollutants such as metals, nutrients, and BOD. Conventional street sweeping as frequently as twice weekly is not effective in reducing these concentrations. Violations of water quality standards are common in receiving waters just downstream from urban discharges, but denial of beneficial use of these receiving waters has not been demonstrated. There is evidence of metals accumulation in sediments as a result of urban runoff.

In Climatology and Meteorology

Radar Research. Radar research advances were notable in two areas. Techniques were developed to allow meteorological interpretation of the differential phase shift between horizontal and vertical linearly polarized signals in rain. The theory for a multi-parameter polarization technique for hydrometeor discrimination was developed. These will lead to better radar measurements of rainfall.



This map shows the average annual sediment yield in tons per square mile for Illinois streams, for water years 1981 and 1982. This is the first attempt to quantify the in-stream sediment yields for the state of Illinois.

Findings relating to hail were significant. The use of two dual-wavelength radars proved that hail could be uniquely detected. Also, wet growth of hailstones in severe hailstorms was established by using fast-scan differential reflectivity measurements.

Climate Change. Studies of changes in climate provided a wealth of new findings. In-state studies show a shift to wetter and cooler conditions typical of those 80 years ago. Visibility has been decreasing steadily in Illinois since 1950. Increases in heavy rain events in the past 20 years have led to 15 percent increases in flooding in Illinois. Insurance-related research of long-term shifts in hail event frequencies in the Upper Midwest-Great Plains showed that since 1950 hail has been increasing in the Great Plains, but decreasing in Illinois and Iowa. A continental-scale study of thunderstorm frequencies showed a 15 percent increase in North America from 1901 to 1945, and a subsequent decrease of 11 percent from 1945 to 1980.

Cloud Studies. Cloud research using models revealed important findings relating to weather modification. Enhancement of cloud growth by seeding appears most likely and greatest when the thermodynamic stratification causes natural cloud development to maximize between 5 and 12 km.

Laboratory research indicated that existing theory may seriously underestimate scavenging of particles by clouds. Particle shape apparently has a major influence on the scavenging rate.

Pests and Weather. Research involving how weather conditions affect pest populations in Illinois has led to development of an objective method to provide back-trajectory analysis in order to estimate the origin of incoming pests. Radar can be used to detect insects in flight. This is a cooperative study with the Natural History Survey.

In Groundwater

American Bottoms Study. An in-depth investigation of groundwater flow in the American Bottoms area was performed for the Corps of Engineers. Water level and pumpage information collected over many years by the Water Survey was summarized, and a computer model was developed and verified by comparing historical and simulated water levels. Existing and future conditions were simulated and evaluated by a statistical method. Alternatives to maintain or lower the groundwater levels at specified levels were designed. The designs included the use of wells to permit pumpage and collectors to permit gravity drainage.

Nitrate Contamination. Under a contract with Winnebago County, an investigation of the groundwater flow system near Roscoe was undertaken to better define how surface and near-surface activities affected groundwater quality. Because of the hundreds of septic tanks in the area, emphasis was placed on nitrate quality. Local soils have an extremely low capacity for attenuating the heavy nitrate loads, so the only mechanism for reducing nitrate concentrations in the groundwater is dilution. Because of this, strict control of housing density in these sensitive areas must be used to maintain acceptable groundwater quality.

Organic Chemical Plume. The high nitrates found at Roscoe led the County Health Department to sample the groundwater for organic compounds. The first five

wells sampled showed very high concentrations of volatile organics, principally trichloroethylene (TCE), a widely used industrial solvent. DENR funded an epidemiological study and additional Water Survey work. Water Survey analyses of groundwater samples from residential and specially constructed monitoring wells indicated the organic contaminant plume follows a very narrow and clearly defined path through the affected subdivision, and is clearly moving in the direction of groundwater flow. Our solute transport computer code is being used to model the contaminant movement. Based on a determined groundwater velocity of 1 foot/day, the organic contaminants may have been in the local groundwater approximately 20 years and beneath the subdivision possibly 10 years or longer.

In Aquatic Chemistry

Corrosion Investigation. A major study of the relation between corrosion and water quality in public water supply systems is yielding interesting results. This USEPA sponsored study involves 19 test installations among 7 different water supplies in central and southwestern Illinois, and required 11,800 chemical analyses during the past year. Although still in progress, some important conclusions are already apparent:

1) In spite of the fact that many of the sites have sources that are considered "hard" waters (which are commonly considered noncorrosive), dissolution of lead solder, copper, and zinc has taken place at several sites.
2) Several of the sites tested produce water that violates one or more of the Primary or Secondary Maximum Contaminant Levels (MCL) set by USEPA, under conditions that would roughly represent new domestic plumbing.
3) Lead is frequently found in excess of the primary MCL in the copper test loops, showing that even small amounts of tin/lead solder in newly installed plumbing can produce potentially dangerous water quality changes.
4) The faucets and chrome-plated brass sampling taps, which represent domestic plumbing fixtures, can contribute to the metal levels in the waters sampled.

In Water Quality

Combined Sewer Overflow Study. A major field investigation that will have profound monetary impact was undertaken at Peoria. The study was to define the mixing zone characteristics of combined sewer overflows into the Illinois River. The study was unique in that nothing of its scope and magnitude had been attempted before. All methodologies, sampling equipment, and sampling procedures had to be developed and fabricated. A stormwater overflow was simulated by pumping river water into the storm sewer using a 4000-gpm pump. Fluorescent dye was added to the pumped discharge. The resulting mixing zone was traced for 4000 feet downstream of the outfall by collecting 600 river samples and determining the dye concentrations with a fluorometer.

The findings supported the conclusion that the combined sewer overflows have very little adverse impact on the receiving waters and consequently a proposed pollution control endeavor would not substantially enhance the water quality of the Illinois River. The proposed stormwater pollution control project was estimated to cost $40,000,000

($30,000,000 of it federal funds). If our findings are accepted, this project will not have to be undertaken, for a considerable savings to Peoria and the nation.

Water Plant Wastes. Savings also may result from a Water Quality investigation in the East St. Louis area. The impacts of wastes from a large 44-mgd water treatment plant were studied, with funding by the Illinois American Water Works Company. The significant findings were that, except during 7-day 10-year low flow conditions, increases in suspended solids in the Mississippi River will not be perceptible even when maximum waste discharges occur. The influence of waste discharges is limited to an impacted area about 100 feet offshore and within 4000 feet downstream of the waste outfalls, and the changes in chemical and physical composition of the river sediments there are not a mark of environmental degradation.

If these findings are accepted, a savings of about $10,000,000 will be realized by the company that supplies potable water to East St. Louis and its environs. This translates into a significant, recurring, annual cost savings to the consumers because of the avoided costs.

Lake Restoration. The Water Quality staff have taken a lead role in developing and demonstrating in-lake water quality management techniques for Illinois lakes. As a result of the successful in-lake management program developed for Lake Eureka, the city of Eureka saved $40,000 in water treatment costs during 1983. This is a savings of about $50 per family a year, and a recurring benefit as long as the lake is used as a source. Similar water quality management techniques have been developed for other lakes: Lake Sparta, Lake Canton, and Lake Nashville, which are water supply lakes, and Lake Rice at Galesburg, the Johnson Sauk Trail Lake, and Lake Le-Aqua-Na, which are recreational lakes.

Surface Water Quality. Natural water quality characteristics of surface waters in Illinois have been altered significantly through the years, and much research has been devoted to the study of the impacts of those alterations. The water quality of most of the major streams and many of the smaller ones has been studied, and results have served the needs and formed the basis of policies by local, state, and federal agencies. It is apparent that subtle changes are occurring in Illinois streams. The changes are reflected by the disappearance of desirable aquatic plants, some mollusks, and fish population. The situation justifies a long-term effort to identify the causative mechanisms and, when deemed feasible, to undertake measures that will reverse the trend.

In Atmospheric Chemistry

Acid and Alkaline Precipitation. Analyses and interpretation of the precipitation chemistry data collected in the National Atmospheric Deposition Program have yielded several interesting findings. One study examined several cases where the rain was either much more or much less acidic than average over a large geographical area.

The unusually acidic cases occurred in the summer, whereas the unusually alkaline cases occurred between late fall and early spring. A case study of one of the unusually alkaline cases revealed high concentrations of calcium and magnesium in the precipitation, prior dry conditions, high winds at the surface, no extensive snow cover, and light precipitation.

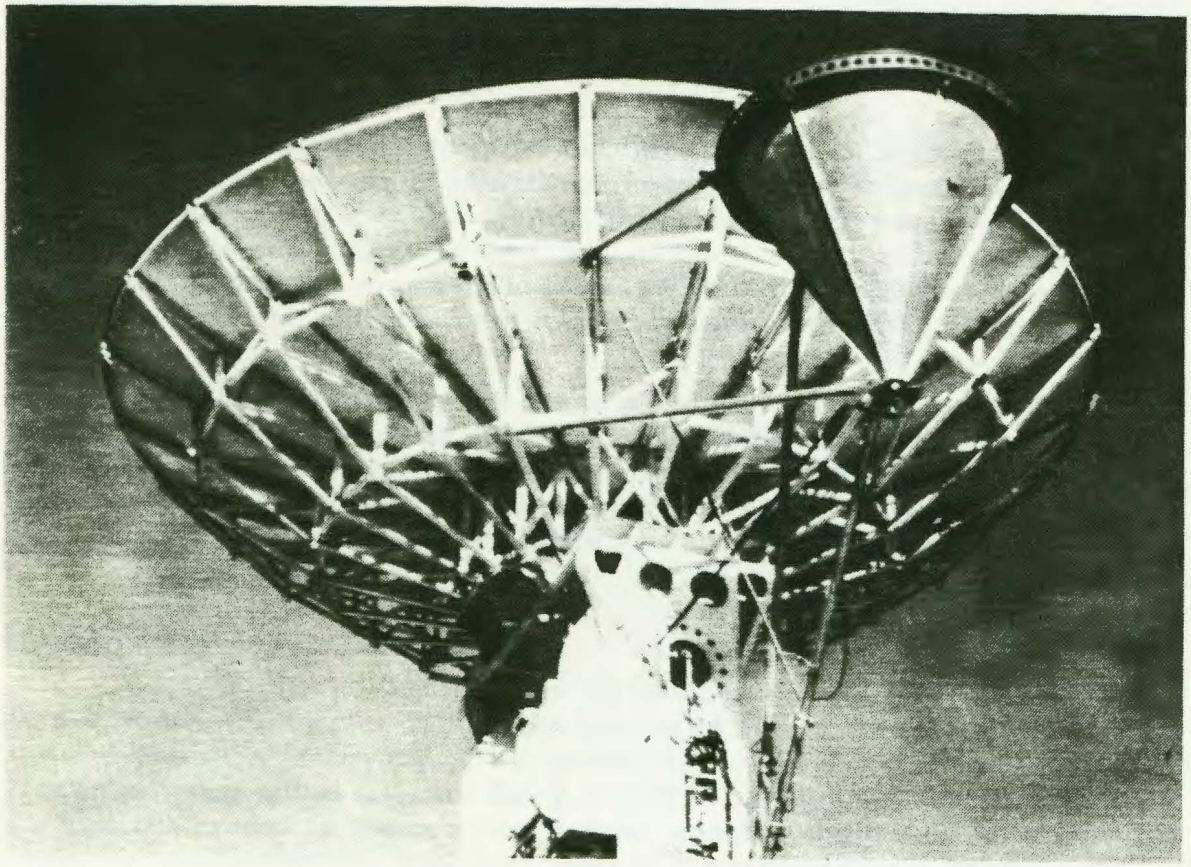
Major Constituents. The identity and relative contributions of all major sources of impurities in precipitation were studied. Factor analysis showed that four major groups of constituents accounted for 86 percent of the variance in the data: dust from the earth's surface, pollutants with gaseous precursors, sea salt, and possible strong acids.

Apportionment of plausible sources by chemical element balance methods yielded estimates of a 2 percent contribution of sea salt (or road deicing salt) to the total mass of impurities in central Illinois precipitation, a 32 percent contribution by ammonium and sulfate ions (including sulfuric acid), a 16 percent contribution from nitrates, a 15 percent contribution from soil dust, and a 12 percent contribution from dust from unpaved roads.

Toxic Substances. Toxic substances in the atmosphere are subjects of growing concern, and their occurrence in precipitation will attract increasing attention in the next few years. Metals and hazardous organic materials are the two classes of toxic substances. Their effects depend largely on their concentrations in the soluble phase, since the soluble phase reacts most directly with the biosphere. In a study based on a data set collected previously in suburban Chicago, solubilities of four heavy metals were examined (Zn, Cd, Cu, Pb). Distributions of percent soluble metals showed differences between metals, and differences for all metals between sample types. Metals were the most soluble in precipitation-only samples, somewhat less soluble in bulk (precipitation plus dry deposits), and least soluble in dry deposits alone. Metal solubility in precipitation is similar to that of other natural waters with respect to the effects of pH and other insoluble materials. Solubility decreases as pH and the concentrations of total mass and insoluble Fe increase.

Dry Deposition. Deposition by dry processes is thought to be about as important as precipitation in depositing airborne acidic and other materials on the earth's surface. However, there is no agreed-upon valid method for monitoring dry deposition routinely over large areas. This led to a field intercomparison of the major techniques proposed. The Water Survey coordinated the field programs in which research groups from 14 U.S. and Canadian institutions participated. Sulfate and particulate sulfur deposition velocities on the order of 0.3 cm/s were found by several independent methods. Nighttime deposition velocities tended to be small, often near zero, while daytime values of up to 1.0 cm/s were observed. A possibly significant contribution to the overall sulfur flux by large (diameter 2.0 micrometer) particle associated sulfate was noted in some periods.

Dust Emissions. A project related to aerosols from the earth's surface involved an assessment of emissions of alkaline dust from large-scale sources such as soil erosion, soil tilling, unpaved roads, forest fires, and others, based on information in the literature. Using a simple mass balance comparison of emissions and deposition (dry and in precipitation) in four states (Colorado, Illinois, New York, North Carolina), we found that estimated emissions far exceed deposition estimated from measurement networks. The emissions exceeded depositions by factors of 2 to 10. It appears that the methods of estimating emissions of alkaline materials need further attention.



Complete renovation of the CHILL radar is now in progress as the first 2-year phase of the 5-year $1.4 million funding granted by the National Science Foundation. After the renovation, this unique radar system will be used as a national facility in various national projects in the following three years.

IMPROVEMENTS IN RESEARCH AND ANALYTICAL FACILITIES

Modern research requires special facilities to allow for analyses and sensing of the environment. Major new facilities were obtained during the year, largely with federal support.

Computer Facilities

Important additions in computer facilities were acquired, bringing the Water Survey to a long desired goal of possession of its own adequate computer capability. The major addition was a $250,000 VAX computer system that was funded by the National Science Foundation. The VAX, with its virtual memory system that allows extremely large programs or data sets to be used and its interactive graphics capability, will improve both speed and quality of research and greatly reduce the costs of computer time.

Two $20,000 micro-computers also were purchased with grant money. One is devoted to the Climate Assistance Service (CLASS) and the other to groundwater research. Major new hardware facilities were obtained to connect Water Survey scientists with the PRIME computer for the LUMP program. Three new IBM personal computers, four new word processing systems, and 13 new terminals also were obtained.

CHILL Radar

Needs for major new equipment for the CHILL radar system led to the hosting of a workshop review session and the preparation of a $1.4 million proposal for 5-year funding. This major funding request was granted by the National Science Foundation. The entire system will be renovated during the first two years of the grant, and it will be used as a national facility in various national projects during the following three years. We consider obtaining long-term support for this expensive and unique national facility a major accomplishment and a tribute to the Water Survey's reputation.

Analytical Facilities

Enlargement of the scope of analytical services and research brought a need for additional equipment and space for the Analytical Chemistry Unit and the Aquatic Chemistry Section laboratories. Particular efforts have been made to upgrade Aquatic Chemistry's chemical instrumentation. A microprocessor-controlled potentiometric titration system and a two-channel segmented-flow Auto-Analyzer were purchased and a coulometric carbon analysis system is being ordered. This equipment will enable precise, accurate and timely analytical determinations for inorganic chemistry research. However, some serious instrumental deficiencies still exist.

Computerization of automated analytical instruments in the Analytical Chemistry Unit's laboratories is under way. This will enable increased efficiency and accuracy when processing thousands of precipitation samples received from across the country. Several groups were shifted to allow additional laboratory space. Relocation of facilities to Adler will provide another plateau of improvement for both groups.

IMPROVED SERVICES TO ILLINOIS

A major thrust of the Water Survey since 1980 has been to increase and improve services to the people of Illinois and governmental elements that serve them. Much progress has been made in services to the public, assistance to special users, assistance to state and national agencies or groups, and in intradepartmental activities.

Services to the Public

The public is served in many ways, but the primary service is giving information about water and weather. During this past year, 21,473 direct requests were answered through phone calls or letters. Of these, 7700 were requests for climate or weather information. Also, 722 were groundwater information requests, many of which require letter-type reports prepared jointly by the Water Survey and the State Geological Survey. There were 840 requests about floodplains and flooding, and more than 5000 concerning different aspects of water quality. These requests come from individuals, consultants, government agencies, industries, and various business concerns (agribusiness, banks, law and insurance offices).

Water/climate information is provided to the public in two other major ways – through the news media and through talks to groups. In 1983–1984, we prepared 46 news releases, gave 167 interviews to newspapers, and provided 126 radio interviews or broadcasts, about a third of which are taped feeds to news bureaus that are picked up by from 20 to 40 radio stations. In addition, we provided 37 TV interviews or programs. Talks before principally lay groups numbered 259.

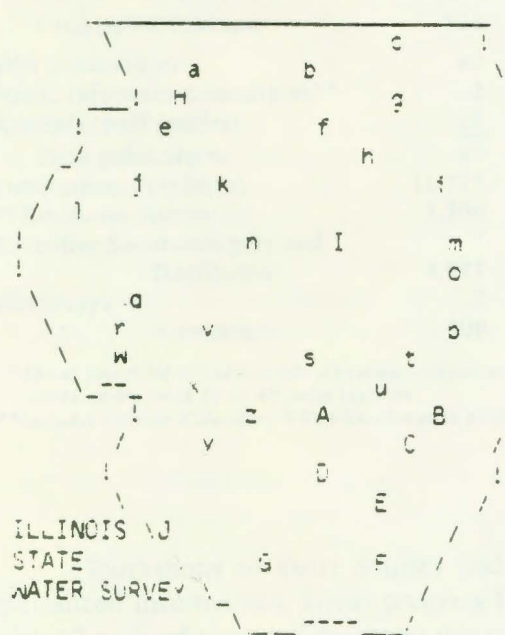
A summary of public contacts during the past four years, included in Table 1, indicates the progress made in these areas.

Assistance to Special Users

Practitioners and consultants in many fields have needs for specialized, state-of-the-art technical information in hydrologic/atmospheric areas. These needs are met by special seminars or lectures, workshops and short courses, technical publications, or other materials.

Brand new this year is a specialized service called the Climate Assistance Service (CLASS). This user-friendly computer system provides a diverse range of 1) climate products for 20 climate regions in Illinois and for the state as a whole; 2) a variety of current water conditions for lakes and reservoirs, streams, and groundwater; 3) the outlooks for future climate conditions (weeks, months, seasons); and 4) predictions relating to agricultural pest outbreaks. This last service is in cooperation with the Natural History Survey with information derived from NHS climate-pest models. CLASS became operational in January 1984 and is now providing near real-time data through computer terminals to staffs at 11 state agencies in Springfield and to 3 federal agencies, as part of a National Weather Service funded demonstration project. After this period, it is expected that the service will be available to many others.

NWS Cooperating Observers and Obs Times:



CITY	PREC	TEMP	CITY	PREC	TEMP
a->Freeport	0700	0700	w->Jerseyvl	0800	0800
b->Belveder	0700	2400	x->Edwrdsvl	0700	----
c->Antioch	0700	0700	y->Bellevil	1600	1600
e->Geneseo	2400	2400	z->Carlyle	0800	0800
f->Paw Paw	0600	0600	A->Salem	1800	1800
g->Aurora	0700	2400	B->Lawrncvl	0700	0700
h->Ottawa	1700	1700	C->Fairfld	1700	1700
i->Kankakee	0700	0700	D->MtVernon	0700	1800
j->Galesbrg	0700	2400	E->McLeansb	0700	0700
k->Princevl	0700	0700	F->Harrisbg	1800	1800
l->La Harpe	0700	1900	G->Carbondl	0700	0700
m->Hoopston	0700	1800	H->Morrison	0700	0700
n->MasonCty	1800	1800	I->Farmer C	0700	1900
o->Danville	1700	1700	J->KaskLock	0700	0700
p->Paris	1900	1900			
q->Jacksonv	0700	0700			
r->WhiteHal	1700	1700			
s->Pana	0700	1900			
t->Mattoon	2400	2400			
u->Effinghm	0700	0700			
v->Carlinvl	1800	1800			

Our Climate Assistance Service (CLASS) provides near real-time climate information and outlooks for Illinois by a user-friendly computer system, the first such system in any state. This maps shows the locations and observation times of the 35 NWS cooperating observers who relay the information to the computer daily.

Table 1. Summary of Information Services

	FY81	FY82	FY83	FY84	4-Year Total
News releases	27	35	45	46	153
Newspaper interviews	25	51	61	167	304
Radio broadcasts or interviews*	32	73	100	126	331
TV interviews or programs	13	26	30	37	106
Total media contacts	97	185	236	376	894
SWS staff talks	140	156	301	259	856
SWS staff lectures, seminars	84	103	128	110	425
Total presentations	224	259	429	369	1281
Total public contacts	321	444	665	745	2175
SWS publications	40	61	57	43	201
Public Information Brochures**	2	5	2	2**	10
Reprints (staff articles)	27	25	35	47	134
Total publications	69	91	94	92	346
Publications distributed	11,725	23,765	37,483	12,774	85,747
PI brochures distributed	3,500	27,700	26,700	**	57,900
Executive Summaries prepared	7	11	8	4	30
Distributed	4,977	8,360	7,170	3,780	24,287
Workshops	3	5	22	17	47
Attendance	300	500	1,980	1,092	3,872

**About one-third of radio totals are taped feeds to news bureaus picked up by from 20 to 40 radio stations*

***Includes Climate Calendars; FY84 brochures in preparation*

Workshops or short courses and conferences are a major means of providing specialized information. Great progress has been made in these activities (see Table 1) with 17 such educational programs this past year reaching more than a thousand persons. Among these were a major groundwater conference, a groundwater monitoring workshop, and the ENR Annual Conference on climate issues, each with more than a hundred attendees. The various lectures, seminars, or other technical presentations totaled 110 this past year. Also, 43 technical reports were written by staff and distributed, and 47 scientific articles were published in journals.

Assistance to State and National Groups

Water Survey expertise has gone into advice and assistance to 99 state and national agencies, advisory boards, task forces, or committees. Major issues of concern included acid rain, hazardous wastes, weather modification and climate data, water resources, and sediment/sedimentation.

The major issue of acidic precipitation called for our expertise gained from operation of the National Atmospheric Deposition Program's central laboratory and extensive atmospheric chemistry research. Key inputs were to the planning and implementation of the National Acid Precipitation Assessment Plan, to research recommendations on acid rain effects for the USEPA, and guidelines for a state policy.

The issue of hazardous wastes was addressed at both state and national levels. Staff participated in the Illinois Attorney General's Task Force on Hazardous Wastes and the ENR Hazardous Waste Plan. They provided extensive technical advice on related groundwater pollution to the Attorney General's Office and the IEPA. A major guide to groundwater monitoring for hazardous wastes for the USEPA evolved from our research.

Extensive contributions were made in the areas of weather modification and the national program on climate data. These involved advice on weather modification districts in Illinois, local cloud seeding projects, and national programs of the National Science Foundation and the U.S. State Department on the use of weather modification. Advice was also given to NOAA in regard to the National Climate Program and to Congressional committees on associated national programs.

In the areas of water resources and sedimentation, advice was given to many state and national groups for research needs and funding, including advice for the proposed National Water Research Center. Advice was given for the implementation of the Illinois Water Use Act of 1983 concerning large groundwater withdrawals, in cooperation with Soil and Water Conservation Districts and other agencies. Staff actively participated with the State Water Plan Task Force on Underground Water and have been key advisors in all phases of the State Water Plan. Staff have been called upon as expert witnesses in hearings and Court cases in regard to the problems of erosion and sediment.

Intradepartmental Activities

In addition to interactive developments for the ENR Hazardous Waste Plan, plans for the Hazardous Waste Research and Information Center, and the State Water Plan, major inputs have been made toward issue papers for various state policies. In addition, plans are going forward for the Illinois Natural Resources Information Center and its referral service.

Major projects are ongoing with the other two Scientific Surveys. Major input and cooperation have been given in the development of research and service activities for the pest and weather project, the Long-Term Ecological Research activities on the Illinois and Mississippi Rivers, the Lands Unsuitable for Mining Program, and the Lake Michigan shores erosion and water quality programs.

In addition, a three-Survey soils and sediment laboratory, now located at the Geological Survey, was established with joint equipment and personnel to provide a facility useful to all three Surveys in the important chemical and physical characterization of soils and sediments.

DATA COLLECTION AND ANALYSIS

Data collection to monitor our atmospheric and water resources, including quantity and quality aspects, is a major activity. We performed 8,098 site visits to

make measurements, with 1,611 man days involved in field activities. However, the signal achievement was the establishment of the ***Illinois Water-Climate Benchmark Network.***

On 19 sites in Illinois, stations have been established to measure 1) all climate variables including soil moisture, 2) the major water conditions including streamflow and groundwater levels, and 3) water quality including soil sediments. The thrust of this benchmark program is to provide continuing baseline information on all key variables over extended time. Involved in this effort were a major study of the streamgage measurement needs of Illinois for the long-term monitoring of our water supplies, and collection of extensive data on water use throughout the state, on a county by county basis and for urban, industrial, and agricultural users.

Other major data collection programs include the following.

The Analytical Chemistry Unit was selected to provide the chemical analyses for the federally mandated National Trends Network, in addition to serving as the Central Analytical Laboratory for the National Atmospheric Deposition Program. The National Trends Network includes many NADP sites but is broader in its geographical coverage. Operating sites for the two programs now number 150 with an anticipated growth to 200 sites by the end of 1984. The Water Survey's involvement in this long-term national effort has led to international exposure and recognition for the quality of work being conducted.

Re-certification of the Analytical Chemistry Laboratory as a Certified Environmental Laboratory by the Illinois Environmental Protection Agency was successful. Laboratories must be re-evaluated every two years in terms of physical facilities, quality control and quality assurance procedures, and results of performance audits on unknown solutions. Designation as a Certified Environmental Laboratory aids Water Survey scientists in attracting funding for projects involved with chemical analyses and also provides users such as the IEPA with chemical determinations of documented precision and bias.

Quality control assistance for the National Urban Runoff Program's data base is a major new program with the U.S. Environmental Protection Agency (USEPA). In this two-year project, Surface Water staff will perform a series of quality assurance tests and then will update and finalize the NURP data base. This will require analysis of data collected for approximately 225 sites around the country. Products from this work will include a publicly available final data set for each site; a set of descriptive manuals including site descriptions, data summaries, and basin maps for each site; and an informational brochure describing the types and quantities of data available for each site.

The effects of various types of sampling mechanisms and materials on the quality of samples collected from groundwater monitoring wells are being tested in a two-year project with the USEPA being carried out by Groundwater and Aquatic Chemistry staff. The first phase, concerned with assessing our current knowledge of potential effects, produced a report, *A Guide to the Selection of Materials for Monitoring Well Construction and Ground-Water Sampling*, that has had broad acceptance with an average of 200 copies requested a month. Phase two, now under way, involves laboratory testing and field studies to identify and assess efficient sampling techniques and ma-

terials for groundwater monitoring near waste disposal sites. The quality of samples is paramount in monitoring efforts to protect our groundwater resources.

Radars were used to gather data on the remote sensing of insect migrations as a part of the pests and weather project. The Water Survey's CHILL radar and the Natural History Survey's GPG radar were used in the joint project to determine the radar capability in detecting, identifying, and tracking influxes of insect pests into Illinois. The tests verified that the radar systems can detect insects in flight if there is sufficient density and pulse volume. Water Survey staff also assisted in designing insect collection traps for use by light airplanes or helicopters.

A major issue in precipitation sampling concerns the length of the sampling period. This becomes a question in the interpretation of rain acidity data. Data from our automated precipitation collectors (without adding any preservatives to the samples) show that the chemical composition of *weekly* samples was not significantly different from that of *daily* samples composited over 1-week periods. This suggests an important savings in data collection.